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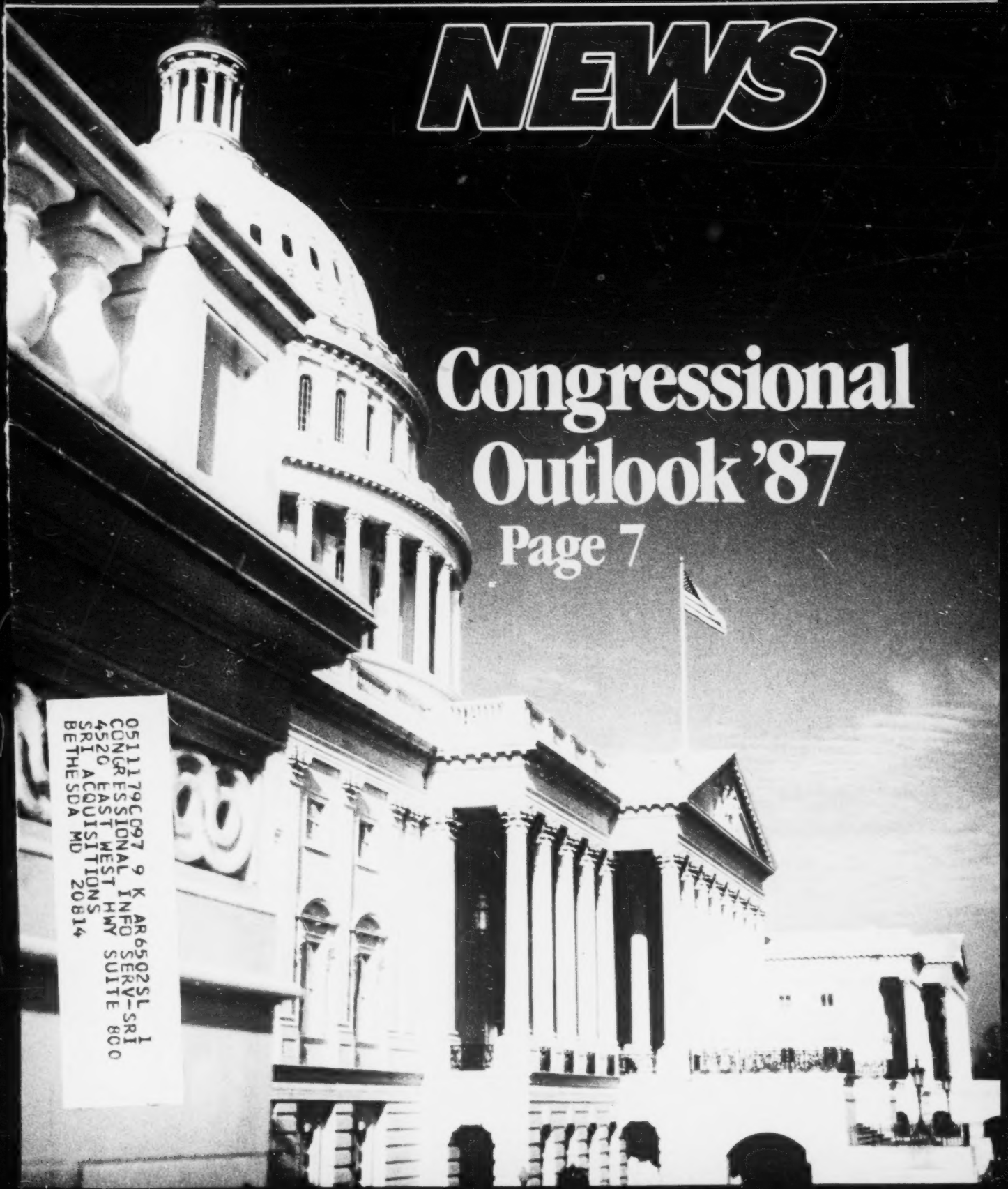
CHEMICAL & ENGINEERING

NEWS



Congressional Outlook '87

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News of the Week

■ **Federal budget proposal calls for higher funding levels for NSF, NASA, and Department of Energy's defense R&D program, but funding cuts for NIH and DOE's energy R&D.** **Page 4**

■ **President Reagan seeks sizable increase in funds for Strategic Defense Initiative, although survey of NAS members shows few believe it a feasible enterprise.** **Page 5**

■ **Construction of 12-story ACS office building is halted by D.C. government officials after monitoring equipment indicated possible wall movement in adjacent historic church.** **Page 5**

■ **Chemist Yuri Tarnopolsky will be allowed to leave the U.S.S.R. within the next few weeks, the latest dissident whose case has been resolved in the past year.** **Page 6**

■ **Nuclear safety research program is in need of reform, according to recent evaluation of the Nuclear Regulatory Commission.** **Page 6**

Business

Poly(ethylene terephthalate) bottle resins supply will rise more than one third this year, allowing for more growth in consumption. **Page 15**

Science

New bimetallic 38-atom Au-Ag cluster, one of largest metallic clusters ever to be made and structurally characterized, may provide insights to the synthesis and structure of higher-nuclearity clusters. **Page 21**

Dietary fat intake is not linked to breast cancer, according to a Harvard medical school study of 90,000 women. **Page 22**

Innovative chemistry exhibit, to be completed in 1988 at the California Museum of Science & Industry, will offer visitors hands-on demonstrations of chemical processes. **Page 23**

Technology

Two hazardous material databases now available in microcomputer version will give emergency response personnel equipped with portable computers immediate access to information. **Page 23**

Cover: Photo by C&EN's David J. Hanson

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News Focus

The 100th Congress, now firmly controlled by the Democrats, likely will have numerous confrontations with President Reagan over environmental issues, chemical weapons, and international trade. **Page 7**

Supplies of PET Bottle Resins To Stay Tight for Next Few Years

Producers of poly(ethylene terephthalate) resins for bottle use will boost capacity more than a third this year; demand could rise even faster

Bruce F. Greek, C&EN Houston

Supplies of poly(ethylene terephthalate) (PET) resins that are used for making bottles will be more plentiful this year than in the past two years. Capacity to make these resins will rise more than one third by the end of 1987. The additional resin supplies could lead to more replacement of glass and metal in containers.

Demand has been rising at more than 10% annually for the past few years and could rise faster now that output will be raised. The result is that no permanent end to the tight supply situation of 1985–86 can be expected this decade. However, expansions now being planned could lift U.S. capacity another 33% before 1990.

These PET resins, often called solid stated because of conversion to a more crystalline form, have a higher molecular weight than PET resins used in fibers. Solid stating is a second step in manufacture, a further polymerization following initial production of PET. In addition to being used to make bottles, solid stated PET resins also are made into films, trays, and other items.

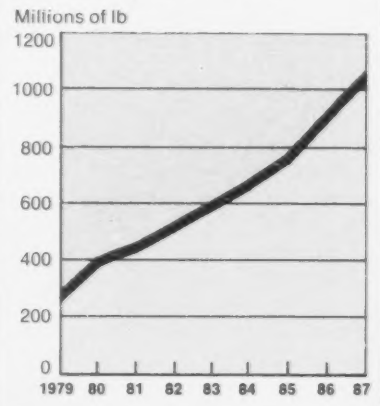
The increase in demand for PET bottle resins has exceeded the growth in total demand for PET resins. The bottle or solid stated resins, PET film resins (with similar molecular weights), and engineering PET resins account for about a third of total PET production. The other two thirds goes into polyester fibers, mainly for apparel manufacture and tire cord. Total PET production was about 5 billion lb in 1986. Less than 20%, or an estimated 925 million lb, was solid stated resins used for bottles. PET film resins production probably reached 650 million lb, and engineering resins accounted for another 100 million to 125 million lb of PET. Over recent years, demand for these nonfiber resins has grown at high rates, while fiber demand has stabilized in the range of 3.3 billion to 3.4 billion lb per year.

Current capacity to produce PET resins exceeds 6 billion lb in the U.S., possibly close to 6.5 billion lb. After fiber requirements are met, ample capacity remains to meet the rising demand for the nonfiber resins. The supply crunch stems from limits in capacity to convert the resins for use in bottles, films, and molded engineered components.

Plants making resins for nonfiber uses increase the molecular weight and thereby increase the intrinsic viscosity, orient films by stretching, and compound resins by adding fillers and reinforcing materials. As plant capacity to make the various kinds of nonfiber-grade resins is added, the basic PET capacity will be available to supply these plants used for the further processing. If, as a result of rising imports of apparel containing polyester fibers, U.S. polyester fiber production declines in the future, then some additional basic PET polymerization capacity could be shifted to making the nonfiber resins in the additional plants.

During 1986, capacity to make sol-

Output of PET bottle resins keeps rising steadily



Source: C&EN estimates

PET bottle resins at a glance

How produced: From poly(ethylene glycol terephthalate) similar to fiber-grade PET (relatively low molecular weight polymer and lower intrinsic viscosity) by further polymerization during which by-product ethylene glycol is removed using hot nitrogen gas and intrinsic viscosity rises from about 0.5 to range of 0.7 to 0.8

Producers: American Hoechst, Eastman Chemical Products, Goodyear Tire & Rubber, ICI Americas

Capacity: Estimated at slightly more than 1 billion lb per year at beginning of 1987

Production: Exceeded 900 million lb in 1986; estimated 1.05 billion lb in 1987

Foreign trade: Exports continue to increase and could total 150 million lb in 1987

Price: 50 to 70 cents per lb, depending on grade

id stated PET resins for bottles and other containers, as well as miscellaneous items, totaled about 950 million lb. With 1986 production estimates at 925 million lb, that capacity was run at more than 97% of its total. If allowances are made for maintenance, changes in grade, and mechanical problems, this operating rate is more than full out.

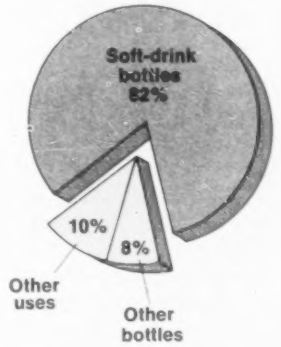
As 1987 begins, an additional 125 million lb of capacity has become available. Eastman Chemical Products just completed startup of an expansion at its Columbia, S.C., plant. Eastman will start up another expansion of the same size during the second quarter. If no problems develop at these new plants, Eastman alone will increase U.S. capacity nearly 200 million lb. About midyear, Goodyear plans to start up the first of three 100 million lb increments of capacity addition.

By the beginning of 1988, capacity in the U.S. will be close to 1.3 billion lb, and possibly higher, if other producers add unannounced capacity through debottlenecking. During 1988, Eastman is scheduled to add 220 million lb and Goodyear 100 million lb of capacity to bring capacity in two years to more than 1.7 billion lb per year. Other producers, such as American Hoechst and ICI Americas, also could add to their capacities, sending the total even higher by 1989.

The capacity expansions for solid stated PET will come on stream just in time this year to ease the tight supply situation. Most of the output from additions will be used in meeting the expected increase in demand of 125 million lb or more. Output in 1987 will top 1 billion lb for the first time and possibly will reach as much as 1.1 billion lb, if some of the current test programs for containers and trays prove PET bottle resins to be the most attractive material.

PET bottle producers are moving to gain more of many other markets. Following their success in introducing 2-L soft-drink bottles, they have taken most of the large-size bottle market from glass. In 1987, the half-liter, or 16-oz, single-service bottle is expected to be the container providing a big share of the growth in solid stated resins. Nearly 70 million lb more resin will be needed to make some 1.2 billion additional 16-oz bottles this year, to meet a forecast total of 3 billion bottles this year. About 25 g of resin are used in each bottle.

Soft-drink bottles dominate PET bottle resin market



Note: C&EN estimates based on forecast U.S. consumption of 800 million lb in 1986.

The outstanding advantages of PET resin for soft-drink bottles are in lower cost, lighter weight, and their shatter-proof property. Disadvantages are shorter shelf life of carbonated beverages caused by carbon dioxide leakage. The cost savings in use of PET resins decline as bottle size declines, even with efforts to reduce the amount of resins per unit. For example, as much as twice as much resin is required for four half-liter bottles as is required for one 2-L bottle.

Metal cans, mostly aluminum, continue to be strong competitors of PET resins for smaller-size containers. Despite improvements in bottle-molding machines that allow faster production rates and thinner walls, and improvements in filling machines that allow faster rates, the competition from cans (and to some extent glass) could restrain the shift toward PET resins.

All other bottles, often called custom bottles, account for a much smaller share of PET bottle resin consumption. Alcoholic beverage bottles apparently have a large potential for PET. So far, a variety of problems have limited such use, however. For example, wine bottles often need barrier coatings to provide greater resistance to oxygen penetration and thus increase shelf life. Liquor bottles have had a mixed reception. The miniature size has conquered the airline industry because of its weight. Larger sizes of liquor bottles are widely available, but reduced liquor consumption nationwide and resistance to plastic bottles by consumers and distillers have prevented the anticipated growth. Beer bottles offer a huge potential market because of the weight and handling advantages. The big drawback to the beer market remains a lack of a hot fill property to allow pasteurization. Barriers to oxygen penetration also continue to be a drawback in making the PET bottle competitive with glass bottles or cans.

Food, cosmetics, toiletries, and pharmaceuticals increasingly have been packaged in containers of PET bottle resins or modifications of the bottle resins. Foods that can be put into containers at relatively low temperatures are going more and more into PET resin bottles and containers, which often are custom-designed. The newer crystallizable PET bottle resins represent a large market potential for use in trays for meals that can be heated in either conventional or microwave ovens, frequently replacing aluminum trays. Currently, the whole area of nonbottle uses of PET bottle resins is only 10 to 15% of the size of the soft-drink bottle market, but it could become a fast growing use as additional resin becomes available.

PET bottles can't be refilled in the U.S. because the temperatures needed for cleaning and sterilizing cause distortion in the bottle. Recycling PET bottles provides a use for the resin, although costs often can't be justified. In the future, however, the volume of resin involved will make recycling more attractive. Recycled PET bottle resins can be used in such products as fiberfill for insulating sleeping bags, jackets, and bedding; unsaturated polyester for glass fiber-reinforced fabricated items; polyols for urethane foam products; thermoformable sheet; industrial coatings; and other smaller-volume products, including decomposition back to the monomers. Recycling thus may eventually become an additional advantage to the use of PET bottle resins. □